Appendix C

Rule 132 Declaration C – **The Wener Device Does Not Fully Discharge Its Inductor**

In the United States Patent and Trademark Office

Appn. Number: 10/724,291

Filing Date: 11/26/2003

Applicant(s): Arthur, James D.

Examiner: Berhane, Adolf D., Art Unit 2838

Rule 132 Declaration C – **The Wener Device Does Not Fully Discharge Its Inductor**

James Arthur declares as follows:

1. I am the inventor in the above patent application.

ASSUMPTIONS

2. The specification of US 6,366,028 B1, Wener, et al., teaches a boost converter employing a single battery cell (page 2, lines 25-36), and a 220 microhenry inductor operating at a frequency of 500-600 kilohertz with an "off" duty cycle of 20-25 percent (Wener, page 5, lines 12-15).

ON-TIME CALCULATION

2. The "on" time of the converter Wener describes can be calculated as (1/500 KHz) * (1 - 0.25) = 1.5 microseconds.

INDUCTOR CURRENT INCREASE DURING ON-TIME

4. From basic physics, the current rise in an inductor is given by $E = L \bullet d(i)/d(t)$. Solving for d(i) and integrating, $i = E \bullet t / L$. (Eqn. C-1)

5. Referring to Wener, Fig. 3, the battery voltage is 1.5 volts. Accordingly, the battery voltage, minus the approximately 0.1 volt Vce(sat) of switching transistor Q2, will apply 1.4 volts charging potential to inductor L1 during transistor Q2's "on" time.

6. Relying on Wener's description, the current rise in inductor L1 during the 1.5 microsecond Q2 "on" time tON would be 1.4 V • 1.5 uS / 220uH = 9.5 mA.

INDUCTOR CURRENT DECREASE DURING OFF-TIME

7. During the "off" time of switch Q2, tOFF, inductor L1 discharges through LED 16 at a voltage equal to the forward voltage of the LED. For a white LED, this voltage will be approximately 4.2 volts. When inductor L1 discharges it is in series with the battery's 1.5 volts, so the discharge voltage across L1 itself is 4.2 - 1.5 = 2.7 volts.

8. With a discharge voltage of 2.7 volts for an interval tOFF of (1/500 KHz) * 25% duty cycle = 500 nanoseconds, inductor L1's current will drop by 2.7 V • 500 nS / 220uH = 6.1 mA.

RESULT OF CALCULATIONS

9. The Wener inductor, under the above conditions and relying on the circuit description provided by Wener, accumulates 9.5 mA - 6.1 mA = 3.4 mA of standing current per switching cycle. The Wener inductor is not fully discharged during the flyback interval tOFF.

CONFIRMATION BY MEASUREMENT

10. A sample of the Wener device was tested on or about January 10th, 2002 by Applicant. At a supply voltage of 1.48 volts, the current drawn was measured to be 88mA. The switching frequency was measured to be 671 KHz. tON was measured to be 1.03 uS. tOFF was measured to be 460 nS. Forward voltage of the LED 16 during tOFF was measured to be 4.2 volts.

11. The maximum decrease in inductor current possible during tOFF is 460 nS • (4.2 V - 1.5 V) / 220 uH = 5.6 mA (Eqn. C-1). It is not possible for the device in question to fully discharge 88 mA from its inductor during its tOFF interval.

12. The average drain of Wener's device of 88 mA with a supply voltage of 1.48 volts is consistent with a continuous-mode converter with a standing inductor current of the average current, less half the ripple current, = 88 mA - (5.6 mA / 2), or 85 mA.

13. I further declare that all statements made herein of my own knowledge are true and that all statements made upon information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application and any patent issuing therefrom.

Signature	Date
James Arthur	November 8, 2005
James Arthur	